

CLAIMS:

The invention claimed is

1. An illuminating device that is capable of replacing an incandescent light bulb comprising:
 - 5 a standard bulb power connector equivalent to the base of a standard incandescent bulb which the device can replace;
 - at least one light emitter;
 - a driving circuit which is electrically connected to the power connector, electrically connected to the light emitter, is compact enough to fit into the volume envelope of the incandescent bulb, consumes power more efficiently than the incandescent bulb, and provides substantially constant illumination over an input voltage range with a maximum-to-minimum ratio of 2 to 1 or more; and
 - 10 a module incorporating the driving circuit and physically attached to the power connector and to the light emitter, is common to more than one type of bulb power connector;
2. The device of claim 1, wherein the light emitter is a solid state light emitting device.
3. The device of claim 2, wherein the solid state light emitting device is a light emitting diode.
- 20 4. The device of claim 1, wherein at least one light emitter is adapted to direct at least 50% of its light onto a reflector.
- 25 5. The device of claim 1, wherein the driving circuit operates at a frequency high enough to allow the circuit to be small enough to fit inside the envelope of the incandescent bulb.
6. The device of claim 1, wherein the driving circuit provides a substantially constant current through the light emitter.

7. The device of claim 1, wherein the driving circuit provides a substantially constant voltage for the light emitter.
- 5 8. The device of claim 1, wherein the module is mounted on a printed circuit board.
9. The device of claim 1, which further comprises a means to select the level of illumination output by the light emitter.
- 10 10. The device of claim 1, which further comprises a means to select the color of illumination output by the device.
11. The device of claim 1, which further comprises a circuit to detect the level of illumination and adjust the output of the light emitter accordingly.
- 15 12. The device of claim 1, which further comprises a circuit to pulse the light.
13. The device of claim 1, wherein the power source may be a battery pack of one or more batteries.
- 20 14. The device of claim 13, wherein the driver circuitry can utilize significantly more of the available battery energy than can the incandescent bulb.
- 25 15. The device of claim 13, wherein the same driver circuitry can operate the same light emitter with substantially the same illumination in configurations utilizing different numbers of batteries connected in series.
16. The device of claim 1, wherein the power source is direct current.
- 30 17. The device of claim 1, wherein the power source is alternating current.

18. The device of claim 1, wherein the power connector is a screw-in base.

19. The device of claim 1, wherein the power connector is a bayonet base.

20. The device of claim 1, wherein the power connector comprises 2 or more pins.

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21. The device of claim 1, wherein the power connector comprises 2 or more wires.

22. The device of claim 1, further comprising a heat sink.

10 23. An improved illuminating device comprising

a standard bulb power connector equivalent to the power connector of a conventional incandescent bulb, which the improved device is capable of replacing; at least one light emitter, which may be a light emitting diode; and a driver circuit electrically connected to the light emitter and to the power connector;

15 where said improvement comprises

an improved circuit which is compact enough to fit into the volume envelope of the standard incandescent bulb, consumes power more efficiently than the incandescent bulb, and provides substantially constant illumination over an input voltage range with a maximum-to-minimum ratio of 2 to 1 or more; and

20 a module incorporating the driving circuit and physically attached to the power connector and to the light emitter.

24. The device of claim 23, where in the light emitter is adapted to direct at least 50% of its light onto a reflector.

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25. The device of claim 23, wherein the improved circuit operates at a frequency high enough to allow the circuit to be small enough to fit inside the envelope of the incandescent bulb.

30 26. The device of claim 23, wherein the improved circuit provides a constant current through the light emitter.

27. The device of claim 23, wherein the driving circuit provides a constant voltage for the light emitter.
- 5 28. The device of claim 23, wherein the module comprises a printed circuit board.
29. The device of claim 23, which further comprises a means to select the level of illumination output by the light emitter.
- 10 30. The device of claim 23, which further comprises a means to select the color of illumination output by the device.
31. The device of claim 23, which further comprises a means to detect the level of illumination and adjust the output of the light emitter accordingly..
- 15 32. The device of claim 23, which further comprises a means to pulse the light.
33. The device of claim 23, wherein the power source may be a battery pack of one or more batteries.
- 20 34. The device of claim 33, wherein the driver circuitry can utilize significantly more of the available battery energy than can the incandescent bulb.
35. The device of claim 33, wherein the same driver circuitry can operate the same light
25 emitter with substantially the same illumination in configurations utilizing different numbers of batteries connected in series.
36. The device of claim 23, wherein the power source is direct current.
- 30 37. The device of claim 23, wherein the power source is alternating current.

38. The device of claim 23, further comprising a heat sink.
39. A method of providing illumination capable of replacing the illumination from an incandescent light bulb comprising steps of:
- 5 providing a standard light bulb power connection equivalent to the power connection of the incandescent bulb which the device replaces;
- electrically connecting a circuit module to the input power contacts of the power connector;
- electrically connecting a light emitter to the output of the module;
- 10 physically connecting the light emitter to the module;
- physically connecting the module to the power connector;
- fitting the module and the light emitter into the volume envelope of the incandescent bulb;
- regulating the power usage of the module to maintain a substantially constant
- 15 illumination from the light emitter, while the source voltage may be in a range with a maximum-to-minimum ratio of at least 2 to 1.
40. The method of claim 39, wherein the input power is supplied by one or more batteries.
- 20 41. The method of claim 39, wherein the circuit module utilizes substantially more available battery energy than can the incandescent bulb.
42. The method of claim 39, additionally comprising adapting the light emitter to direct at least 50% of its light onto a reflector.
- 25 43. The method of claim 39, wherein the power connection is a screw-in base.
44. The method of claim 39, wherein the power connection is a bayonet base.
- 30 45. The method of claim 39, wherein the power connection comprises 2 or more pins.

46. The method of claim 39, wherein the power connection comprises 2 or more wires.
47. The method of claim 39, wherein the light emitter is a solid state light emitting device.
48. The method of claim 45, wherein the solid state light emitting device is a light emitting diode.
- 5 49. The method of claim 39, further comprising conveying excess heat away from the circuit module and light emitter.

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